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EXAMINER	
UHLIR, NIKOLAS J	
ART UNIT	**PAPER NUMBER**
1773	6

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Please find below and/or attached an Office communication concerning this application or proceeding.

MK-6

Office Action Summary	Application No. 09/781,975	Applicant(s) HARKNESS ET AL.	
	Examiner Nikolas J. Uhlir	Art Unit 1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Claims 11-19 are noted to contain nominal method steps. At this time restriction has not been required between the product claims 1-10 and 20 and the method claims 11-19 because the method claims do not recite any significant manipulative steps and therefore considered as part of the product claims. If the method claims are amended to contain significant method steps they will be subject to restriction based on original presentation.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-2, 4-12, and 14-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In the instant case, Claims 1 and 11, upon which claims 4-12 and 14-19 are dependent, recite the limitation a "Cr-X" material. It is unclear exactly what the applicant is claiming as "X." While the specification indicates that X is limited to elements such as Al, Ca, Ti, V, Mn, Fe, Co, Ni, Zi, W, or a mixture thereof, claims 1 and 11 as written are open to "X" being anything. Clarification is required.

4. Claims 8 and 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 8 and 18 recite the limitation "further

optionally comprising," it is unclear to the examiner which limitations following this statement are optional. Furthermore, claims 8 and 18 recite the limitation "roughly equivalent to a (0002) interplanar spacing." It is unclear to the examiner what is meant by "roughly equivalent." Clarification is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-4, 6-7, 11-14, 16, and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Suzuki et al. (US5143794) as evidenced by The Handbook of Chemistry and Physics, 81st edition, 2000.

For the purpose of this examination the examiner has interpreted "Cr-X" to mean an alloy of Cr and at least one element selected from the group consisting of Al, Ca, Ti, V, Mn, Fe, Co, Ni, Zi, or W, as is commensurate in scope with the specification, page 5, line 20-page 6, line 9.

Suzuki et al. teaches a magnetic recording medium that comprises a substrate, a seedlayer disposed on the substrate that is comprised of a Cr-X containing material, and a magnetic layer, wherein a solid solubility of said X is at least 3 atomic % in Cr. Suzuki et al. teaches a specific embodiment wherein one or more chromium or chromium alloy non-magnetic metallic underlayers are formed onto a non-magnetic substrate, after which a magnetic layer is deposited on the chromium or chromium alloy

underlayer. Both the underlayers and the magnetic layers are formed via DC magnetron sputtering, and contain .5 atomic % of oxygen. Specific Chromium alloys cited include Cr -Ti, Cr-W, and Cr-Mo (columns 25-26, example 7). This example meets all of the compositional requirements of claims 1, 3, 4, and 6-7, as well as the method requirements of claims 11, 13, and 16.

Regarding claims 1 and 11, wherein the applicant requires that the solubility of "X" is at least 3 atomic % in chromium. The examiner takes the position that the solubility of one material into another material is a material property. Thus, when the material cited as being suitable for use as "X" is Ti, this limitation is met, as Ti is listed by the applicant on page 5, lines 20-21 of the specification as a suitable "X" material possessing this property. Furthermore, Suzuki et al. teaches that an alloy of one element selected from Cr, Mo, W, V, Nb, or Ta and 1-30 atomic % Ti is a suitable material for the underlayer (column 9, lines 5-16).

Regarding claims 2 and 12, wherein the applicant requires that the "X" material have a heat of oxide formation that is less than that of Cr and a lattice tuning capability of at least 2% that of Cr. The examiner takes the position that the heat of oxide formation and lattice tuning capability of a material is a material property. Thus, when the material specified for use as "X" by Suzuki et al. is Ti, this limitation is met, as Ti matches a material specified by the applicant on page 5, lines 20-21 of the specification. Further, since it is known that the heat of formation of TiO_2 is -944kj/mol (~225 kcal/mol) (81st edition of the Handbook of Chemistry and Physics), which is lower than the heat of

formation of Cr_2O_3 disclosed by the applicant on page 18, line 13 of the specification, these limitations are met.

Regarding claim 14, wherein the applicant requires a method for manufacturing the magnetic recording medium of claim 11, comprising an oxidizing step to oxidize a portion of the seed layer. Suzuki et al. teaches that the deposition of the underlayer is carried out utilizing an argon gas that contains .05 vol% of oxygen, resulting in an - column 2, line underlayer exhibiting an oxygen content of .5 atomic %. (column 25, line 47-column 26, line 20). Although Suzuki et al. does not specifically teach "oxidizing" a portion of the seedlayer, the examiner takes the position that the oxygen present in the metallic seedlayer taught by Suzuki et al. will oxidize at least some portion of the magnetic seedlayer after the seedlayer is formed. Thus, this limitation is met.

Regarding claim 20, wherein the applicant requires a magnetic recording medium comprising a means for low noise recording and a magnetic layer. The applicant has defined "means for low noise recording" on pages 6 and 7 of the specification as "a layer comprising a Cr-X containing material, wherein a solid solubility of said X is at least 3 atomic percent in Cr, a heat of oxide formation (-ΔHf) of said X is greater than 200kcal/mol or a lattice tuning capability of said x is at least 2% that of Cr." As discussed above, the material disclosed by Suzuki et al. meets the applicant's definition of a "means for low noise recording." Thus, this limitation is met.

7. Claim 20 is rejected under 35 U.S.C. 102(b) as being anticipated by Bertero et al. (US6150015).

Bertero teaches a magnetic recording medium comprising a substrate, a magnetic thin film layer on the substrate, a Cr or Cr alloy layer formed between the substrate and the magnetic layer, and a ultra-thin nucleation layer formed between the Cr or Cr alloy underlayer and the magnetic layer (column 11, lines 45-50). Further, Bertero et al. teaches that the grain size of a magnetic layer grown over an underlayer is controlled by the grain size and spacing of the underlayer (column 14, lines 18-25), and that a smaller grain size results in a magnetic medium exhibiting lower noise than a magnetic layer with a larger grain size (column 14, lines 28-32). This reads on the applicants requirement for a "means for low noise recording" in claim 20.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 5, 9, 15 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. as applied to claims 1, and 11 above, and further in view of Tanahashi et al. (US6001447).

Suzuki et al. teaches all of the limitations of claims 5, 9, 15 and 19 as written above, except for those limitations stated below.

Suzuki et al. does not teach a magnetic recording medium that further comprises a Cr containing underlayer formed between the magnetic layer and seed layer as required by claims 5 and 15. Further, Suzuki et al. does not teach a Cr containing

underlayer that comprises CoCr, wherein the magnetic medium having a CoCr underlayer exhibits a stronger CoCr (110) peak by X-Ray crystallography than that of a material that has a seedlayer formed of substantially pure Cr, as required by claims 9 and 19.

However, Tanahashi et al. teaches a magnetic recording medium that comprises a substrate, a multilayer underlayer system, and a magnetic layer (column 8, lines 7-24). The multilayer underlayer system comprises one layer comprising a hexagonal close packed (hcp) material that is in contact with the magnetic layer (column 2, line 64-column 3, line 2). For the purpose of lattice tuning capability with the magnetic layer, the hcp layer should preferably have Co and Cr as its main components (Column 4, lines 16-27). In addition, the multilayer underlayer system also comprises an body centered cubic (bcc) underlayer upon which the hcp layer is formed. Materials suitable for forming the bcc underlayer layer include Cr and Cr alloys such as CrTi, CrV, CrMo, and the like (column 4, lines 59-67). The magnetic layer is formed from a Co containing alloy, such as CoCrNI, CoCrTa, and CoCrPt (column 2, lines 54-58). Magnetic recording media having this structure have magnetic layers that exhibit better crystallinity then magnetic recording media that have the magnetic layer formed directly on a Cr or Cr alloy underlayer (column 3, lines 4-13 and column 4, lines 16-25).

Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to include a CoCr layer as taught by Tanahashi et al. between the Cr or Cr alloy underlayer and the magnetic layer taught by Suzuki et al.

One would have been motivated to make this modification due to the teaching in Tanahashi et al. that magnetic layers formed on top of a substrate/bcc Cr or Cr alloy underlayer/CoCr underlayer structure exhibit better crystallinity than magnetic layer formed on top of a substrate/bcc Cr or Cr alloy underlayer structure. One would have been further motivated to make this modification due to the fact that the alloys used to form the bcc underlayer and the magnetic layer in Tanahashi et al. are identical or similar to those used to form the bcc underlayer and magnetic layer in Suzuki et al.

Regarding claims 9 and 19, wherein the applicant requires that a magnetic recording media comprising a Cr-X underlayer and a CoCr containing underlayer to form a first magnetic medium exhibit a stronger (110) peak by X-ray crystallography than that of a second magnetic recording medium that comprises a Cr underlayer and a CoCr containing underlayer. The examiner takes the position that the strength of an X-ray crystallography peak is a material property. Thus, as the combination of Suzuki et al with Tanahashi et al. results in a material having the same structure and is formed from the same materials as disclosed by the applicant in both the specification and the claims, this limitation is met.

10. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al as applied to claims 1, 11 above, and further in view of Bertero et al. (US6150015).

Suzuki et al. teaches all of the limitations of claim 17 as written above, except for those limitations stated below.

Suzuki et al. while disclosing the medium of claim 1 and the method of claim 11, does not teach an oxidized seedlayer wherein the oxidized portions have a grain size of less than 10nm.

However, with respect to grain size, Suzuki et al. teaches that the grain size of the magnetic layer is adventitiously minimized (<100nm) in order to reduce the media noise (column 12, lines 19-27).

Bertero et al. teaches that the grain size of a magnetic layer grown over an underlayer is controlled by the grain size and spacing of the underlayer (column 14, lines 18-25). Thus, the examiner takes the position that the grain size of an underlayer is a results effective variable. One would increase the grain size of the underlayer to increase the grain size of the magnetic layer, and vice versa. Further, Bertero et al. teaches that a magnetic layer with a smaller grain size exhibits lower noise than a magnetic layer with a larger grain size (column 14, lines 28-32).

Thus, it would have been obvious to one with ordinary skill in the art at the time the invention was made to optimize the grain size of the underlayer taught by Suzuki et al. to the desired range.

One would have been motivated to make this modification due to the teaching in Suzuki et al that the grain size of the magnetic layer is adventitiously minimized in order to reduce the noise of the magnetic media, and the teaching in Bertero et al. that the grain size of a magnetic layer grown on an underlayer is controlled by the grain size of the underlayer, and the teaching in both Bertero et al. and Suzuki et al. that a magnetic layer with a smaller grain size exhibits lower media noise.

11. Claims 8, 10, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. in view of Tanahashi et al. as applied to claims 1, 9, and 11 above, and further in view of Ivett et al. (US5298324).

Suzuki et al. as modified by Tanahashi et al. has been discussed above.

Suzuki et al. as modified by Tanahashi et al. does not teach a magnetic recording medium comprising a Cr-X seed-layer, and a CoCr underlayer, wherein the Cr-X material is Cr-10W, and the CoCr material is Co-37Cr as required by claim 10. Further, Suzuki et al. as modified by Tanahashi et al. does not teach a Cr-X seedlayer or a method for making a Cr-X layer, wherein the Cr-X seedlayer has a (110) inter-planar spacing that is roughly equivalent to the (0002) inter-planar spacing of a HCP alloy within a CoCr containing underlayer or a magnetic layer deposed on top of the seed layer, as required by claims 8 and 18.

However, with respect to the amount of Cr in the CoCr containing underlayer, Tanahashi et al. teaches that for the purpose of lattice matching with the magnetic layer, the CoCr hcp layer should preferably contain between 26-50 atomic % Cr. When the amount of Cr drops below 26%, the hcp is magnetic and affects the magnetic properties of the magnetic layer formed on top of it. Conversely, if the amount of Cr exceeds 50%, the hcp layer cannot exhibit good crystalline structure (Column 4, lines 16-27). Thus, the examiner takes the position that the amount of Cr in the CoCr layer is a results effective variable, and it would have been obvious to one with ordinary skill in the art at the time the invention was made to vary the amount of Cr in the hcp layer to optimize the lattice

matching of the CoCr layer with the magnetic layer, while simultaneously avoiding the drawbacks of too little or too much chromium.

With respect to the amount of W in the Cr-X seedlayer, Ivett et al. teaches a magnetic recording medium comprising a substrate, an underlayer comprised of Cr-W, and a Co based magnetic layer (column 3, lines 30-35). The Cr-W layer typically comprises 85-99 atomic % Cr(1-15 atomic % W). The amount of W used is chosen so as to achieve lattice matching between the Cr-W layer and a Co based layer deposited on top of the Cr-W layer (column 4, lines 64-68). As the atomic size of Cr and Co is roughly the same, the lattice matching is achieved due to the large atomic radius of W as compared to Cr and Co (column 5, lines 55-64). Thus, the examiner takes the position that the amount of tungsten is a results effective variable. The addition of more tungsten will result in greater expansion of the Cr lattice then the addition of less tungsten. Thus, it would have been obvious to one with ordinary skill in the art at the time the invention was made to optimize the amount of tungsten used in the Cr-W underlayer in order match the lattice spacing of the underlayer to a Co based layer deposited on top of the Cr-W layer. Magnetic media that have a Cr-W underlayer that is lattice matched with the Co based alloy layer deposited above the Cr-W layer exhibit no reduction in coercivity as the thickness of the underlayer is increased, thus the thickness of the underlayer need not be tightly controlled as was required by other conventional underlayers (column 6, line 62-column 7, line 9)

Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to vary the content of W and Cr in the Cr-W and CoCr

underlayers taught by Suzuki et al. as modified by Tanahashi et al. to optimize the lattice match between the underlayer/seedlayer and the magnetic layer. underlayer or magnetic layer taught by Suzuki et al as modified by Tanahashi et al.

One would have been motivated to make these modifications due to the teaching in Tanahashi et al. that the amount of Cr in the CoCr layer impacts the lattice structure of the CoCr layer, and the teachings in Ivett et al. that the amount of W added to a Cr-W underlayer impacts the lattice structure of the Cr-W layer and that magnetic recording media having a Cr-W seedlayer that is lattice matched to a Co based layer deposited on the Cr-W layer exhibit no reduction in coercivity as a function of the seedlayer thickness.

Regarding claims 5 and 15, although neither Suzuki, Tanahashi, or Ivette explicitly teach optimizing the (110) spacing of the Cr-X material to the (0002) inter-planar spacing of a HCP alloy within the CoCr underlayer or the magnetic layer, the examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time the invention was made to match **any** lattice spacing of the seedlayer to **any** lattice spacing of either an underlayer or magnetic deposed above the seedlayer. One would have been motivated to due so due to the teaching in Ivette et al. that a magnetic recording media that has a seedlayer that is lattice matched to an underlayer exhibits no reduction in coercivity as a function of the seedlayer thickness.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

Nju
August 23, 2002

STEVAN A. RESAN
PRIMARY EXAMINER